Claims

1. A method for rapid refrigeration at a useful temperature T_U which employs a thermochemical system based on the coupling of reversible physico-chemical phenomena between a gas and a solid or liquid sorbent, said phenomena being exothermic in one direction and endothermic in the other direction, called the LT phenomenon and the HT phenomenon, said phenomena being such that, at a given pressure, the equilibrium temperature of the LT phenomenon is below the equilibrium temperature of the HT phenomenon, said method consisting in carrying out at least one cycle consisting of a refrigeration step and a regeneration step starting from an initial state in which a reactor in which the LT phenomenon occurs and a reactor in which the HT phenomenon occurs are at the ambient temperature and isolated from each other, the refrigeration step consisting of the endothermic phase of the LT phenomenon, which releases a refrigerant fluid G in gas form, the regeneration step consisting of the endothermic phase of the HT phenomenon, which releases the fluid G in gas form, said method being characterized in that:

- the LT phenomenon is a liquid/gas phase change of the fluid G or an absorption of the fluid G by a liquid sorbent;

- the HT phenomenon is a sorption of the fluid G by a liquid or solid sorbent;

- the endothermic phase of the LT phenomenon takes place in a reactor thermally isolated from the ambient environment; and

- the exothermic phase of the LT phenomenon takes place in a condenser in permanent communication with the reactor in which the HT phenomenon takes place, the condensed fluid G then being transferred into the reactor in which the endothermic phase of the LT phenomenon takes place.

2. The method as claimed in claim 1, characterized in that:

- the refrigeration step comprises:

• a phase A1 during which the reactor in which the HT phenomenon takes place (hereinafter denoted by HT reactor) and the reactor in which the LT phenomenon takes place (denoted hereafter by LT reactor) are placed in communication with each other; and

• a phase A2 during which the HT and LT reactors are isolated from each other and the HT reactor is heated; and

- the regeneration step comprises:

• a phase C during which the HT reactor is heated and in permanent communication with a condenser;

• a phase D consisting in transferring the fluid G in liquid form from the condenser to the LT reactor; and

• a phase E consisting in cooling the HT reactor in order to return it to the initial conditions.

3. The method as claimed in claim 2, implemented for ice production, characterized in that it comprises, between passive refrigeration phase A2 and phase C of the regeneration step, an intermediate phase B for separating the pieces of ice from the support.

4. The method as claimed in claim 3, characterized in that phase B consists in bringing the condenser into communication with the LT reactor for a short period so as to bring some of the hot gas released by the endothermic step of the HT reactor into proximity with the support on which the pieces of ice form.

5. The method as claimed in claim 3, characterized in that phase B is implemented using electrical resistance elements integrated into or attached to the wall of the LT reactor, or in the reactor BT, near the

ice support.

6. The method as claimed in claim 2, characterized in that, during step A1, the heat generated by the exothermic step in the HT reactor is extracted.

7. The method as claimed in claim 2, characterized in that step D is carried out during execution of step C.

8. The method as claimed in claim 1, characterized in that the reactor in which the HT phenomenon takes place and the condenser are permanently in communication with each other.

9. A device for implementing the method as claimed in one of claims 1 to 8, characterized in that:

- it comprises two reactors (1) and (2) and a condenser (4) provided with means (8) for extracting the heat;

- the reactor (2) is connected to the condenser (4) via a line (10) provided with a valve (5);

- the condenser (4) is connected to the reactor (1) via a line (9);

- the reactor (1) is provided with heating means (6) and with means (7) for extracting the heat, and it contains a liquid or solid sorbent capable of reversibly sorbing a refrigerant fluid G; and

- the reactor (2) includes means (11) for thermally isolating it from the ambient medium, and it contains the liquid form of the refrigerant fluid G or a liquid sorbent capable of absorbing the refrigerant fluid G.

10. The device as claimed in claim 9, characterized in that it further includes a line (12) provided with a valve (13) that connects the reactor (1) directly to the reactor (2).

11. The device as claimed in either of claims 9 and 10, characterized in that the reactor (2) is an

evaporator.

12. The device as claimed in one of claims 9 to 11, characterized in that the reactor (2) is an evaporator provided with an ice tray (3).

13. The device as claimed in claim 12, characterized in that the ice tray forms an integral part of the evaporator.

14. The device as claimed in claim 12, characterized in that the ice tray is fixed to or placed on a wall of the evaporator that is in contact with the boiling refrigerant fluid, directly or via fins.

15. The device as claimed in claim 13, characterized in that the evaporator is formed by two hollow sections that have different concavities and are joined together along their longitudinal edges, the section having the smaller concavity being placed above the section having the larger concavity, the respective concave parts being upwardly directed, the section having the smaller concavity forming the ice tray and the section having the larger concavity forming the reservoir for the refrigerant fluid.

16. The device as claimed in claim 15, characterized in that the concavities are formed by portions of circular or elliptical arcs of different diameters, the sections being portions of longitudinally truncated tubes of cylindrical or elliptical cross-section.

17. The device as claimed in claim 15, characterized in that the sections are in contact with each other along their lower generatrices.

18. The device as claimed in one of claims 12 to 17, characterized in that the ice tray is divided into compartments by partitions.

19. The device as claimed in claim 18, characterized in that the partitions are hollow and

contain a phase change material.

20. The device as claimed in claim 15, characterized in that the lower section is provided with cells filled with a phase change material.

21. The device as claimed in claim 18, characterized in that the partitions include notches.

22. The device as claimed in claim 15, characterized in that fins are placed in the space between the two sections.

23. The device as claimed in claim 22, characterized in that the fins are hollow and contain a phase change material.

24. The device as claimed in claim 14, characterized in that:

- the ice tray is formed by a container (100);

- said container is provided with a thermal insulation (109) placed around its periphery;

- said container is removable and fits onto the lower part of the evaporator (102), which also includes a thermal insulator (108);

- the evaporator (102) is provided with external fins (101) that are immersed in the ice tray and with internal fins (103); and

- the evaporator is provided with a pipe (104) for connecting it to the rest of the device.